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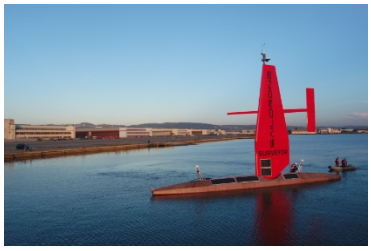
Thank you for helping to support student researchers

We're excited to announce that we reached our goal of 45 donors during this year's (603) Challenge, which unlocked an extra $1,000 from an anonymous underwriter. Thank you to everyone who contributed to this year's event! All the money we raised will go to support students who register for (and attend, if applicable) professional conferences. If you know a student who needs financial support for this purpose, please reach out to Rebecca Irelan at rebecca.irelan@unh.edu. We will send out additional reminders to apply for conference funds throughout the year as well.

EOS IN THE NEWS



Setting Sail for Science

Larry Mayer, Kevin Jerram, and Paul Johnson have developed software that will help a crewless sailboat map the seafloor

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Seeing the Infrared

Scott Ollinger, Andy Ouimette, and Jack Hastings received a NASA grant to improve satellite-based estimates of forest growth rates

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Sound Waves of the Future

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Sea Change

Jennifer Dijkstra’s research indicates climate change affects deep-sea corals and sponges differently

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e Freeze-Thaw

Alix Contosta delves into her research on winter weather whiplash

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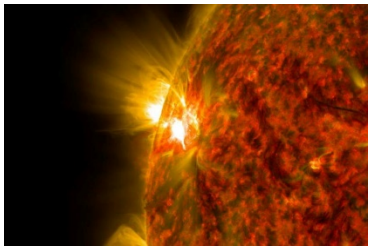

A Simple Instrument for Outer Space

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$3.8 Million for Climate Change, Snow Depth, and Space Research

Alix Contosta, Jennifer Jacobs, and Chris Mouikis each received grants to focus on key research areas

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Ocean Noise: Study to measure the oceans' 'year of quiet'

Jennifer Miksis-Olds weighs in on the importance of listening to the ocean

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10x10: Sand Beach

Alyson Eberhardt, Larry Ward, and alumna Donya Frank-Gilchrist discuss how beaches move

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i explores the impacts

Smart Data for Resilient Forests: Measuring Snowmelt and Leaf Out Timing

Alix Contosta discusses her low-cost sensor set-up

SEMINARS AND SPECIAL EVENTS

SMSOE Graduate Research Symposium
May 5, 10 a.m. – 2:30 p.m.

KiNet-X Rocket Launch
Watch live on May 7, 7:58 p.m.
Rocket will carry an instrument built by SSC scientists & students

Quantifying Uncertainties in Electric Field Measurements Using Whistler-Mode Waves from Van Allen Probes
Speaker: David Hartley, Assistant Research Scientist, Department of Physics and Astronomy - University of Iowa
May 12, 3-4 p.m.

[Data Mining the Fokker-Planck Radial Diffusion Equation with Neural Networks]

Speaker: Enrico Camporeale, Research Associate - University of Colorado, Boulder
May 19, 3-4 p.m.
Part of the Space Science Seminar Series

[2021 N.H. Climate Summit]
May 26 & 27

PREVIOUSLY RECORDED SEMINARS

[Urban Songbird Responses to the COVID-19 Shutdown Soundscape]

WELCOME

Greetings to Dr. Gabe Venegas, a research assistant professor who joined CARE this month with expertise in sediment acoustics. You may know him from his 2020 post-doc in CCOM. Welcome aboard, Gabe!

Please send any news items or suggestions for future Convergence content to Rebecca Irelan at rebecca.irelan@unh.edu.

Convergence is produced by the Institute for the Study of Earth, Oceans, and Space.

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Setting Sail for Science

UNH-produced software will help crewless sailboat map seafloor

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Monday, April 26, 2021

THE SAILDRONE SURVEYOR, A REMOTELY OPERATED SAILBOAT, WILL MAP THE SEAFLOOR USING SOFTWARE DEVELOPED BY UNH RESEARCHERS. PHOTO BY SAILDRONE.

What if mapping the seafloor could be a round-the-clock, environmentally friendly endeavor? A new remotely operated sailboat is soon heading for the high seas for proof-of-concept testing, and scientists are hopeful it will offer a boost in efficiency over current mapping efforts.

This spring, the Saildrone Surveyor, a 72-foot vessel without a crew onboard, will make its maiden voyage from San Francisco to Hawaii, collecting environmental data and mapping the ocean floor along the way. UNH researchers have been working behind the scenes to make the trip a successful one, most notably by developing software that will ensure the seafloor mapping data is collected with as few glitches as possible and then compressed for satellite transfer to shore.

To date, less than 20% of the global seafloor has been mapped; even on a trip from California's coastline to Hawaii, it's surprisingly easy to find areas of the ocean that have not yet been charted, says Larry Mayer, director for the UNH Center for Coastal and Ocean Mapping (CCOM), who has been involved in the project.

"I'm keen to demonstrate the viability of this sort of approach. If successful, this will represent a quantum leap in our ability to map the global ocean."

The Surveyor is a wind and solar-powered vessel equipped with a suite of sensors and multi-beam echosounders often found on much larger research ships; it's purported to be much quieter and significantly less reliant on fossil fuels than traditional ocean mapping vessels, making it a more environmentally friendly alternative. The Saildrone company, based out of Alameda, California, designed and built the vessel, with development input provided by researchers from the Monterey Bay Aquarium Research Institute and CCOM.

NOAA's Office of Ocean Exploration and Research provided funding for the software development and the project's sea acceptance trials. The NIPPON Foundation-GEBCO Seabed 2030 Project is funding the collection of new seafloor mapping data during the Hawaii transit.

"To me, this project is a match made in heaven," Mayer says of the collaboration between CCOM and Saildrone. "We've been working for years on ways to more efficiently and appropriately process seafloor mapping data as we move into the world of autonomy and thus the collaboration between Saildrone and CCOM makes great sense."

Kevin Jerram, a CCOM research scientist, and Paul Johnson, a CCOM data manager, have helped to plan for, acquire and process the test data to make sure the Surveyor will accurately map the seafloor once it's on its way to Hawaii. They coordinated the sea trials for the Surveyor's mapping systems, a series of calibrations and test surveys that took place off California in late winter to help identify challenges of a new installation on a brand new vessel and make the necessary changes to ensure smooth operations. "The sea trials were important for setting a data quality baseline, ensuring that future missions funded by NOAA and other partners will produce accurate maps as efficiently as possible during the Surveyor's time at sea," Jerram explains.

Their involvement with the Surveyor has also benefitted CCOM — Jerram says they gained early experience with the latest mapping hardware and software that is now being installed in other

vessels, including the NOAA ship Okeanos Explorer, on which he is currently aboard for similar testing.

“It’s exciting to be involved in this new approach to deepwater mapping, and I truly enjoyed the collaboration with the Saildrone team,” Jerram says. “It feels really good to be getting back to sea, working both remotely and in person.”

If all goes well with the Surveyor’s voyage to Hawaii, Mayer hopes the vessel can be used for the Seabed 2030 mission, an international effort to map the entire global seafloor by the year 2030.

“I’m keen to demonstrate the viability of this sort of approach. If successful, this will represent a quantum leap in our ability to map the global ocean,” Mayer says. “With less fuel usage, no crew costs, the ability to map 24 hours a day, and no need to return to port on a regular basis, we can really increase the efficiency. It makes the aspirational goal of mapping the world’s oceans more hopeful.”

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- WRITTEN BY:

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Seeing the Infrared

Researchers receive grant to improve estimates of forest growth rates

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Monday, April 26, 2021

It takes more than just an aerial view to actually see the forest for the trees. UNH researchers have received a three-year, $200,000 grant from NASA to improve the satellite-based estimates of forest growth rates in the Northeastern U.S. Results from this project could lead to more accurate carbon cycle models and climate change projections.

It’s a bit of a paradox that we can learn more about plant growth from the wavelengths they’re not using in photosynthesis than the wavelengths they are using.”

Trees use the visible wavelengths of sunlight for photosynthesis and reflect near-infrared light, which they don’t use. Scientists use satellite data to measure the ratio of infrared to visible reflectance over broad spatial scales — higher values indicate greater levels of growth or biomass, so this technique is frequently used to study forests over vast geographic areas. However, the trees’ leaf angles in relation to the sun, their leaf-to-stem ratios and their canopy shape all influence the infrared reflectance of a forest and can change over time. This grant will enable scientists, for the first time in history, to couple these data with simultaneous measurements of the forests’ nitrogen, photosynthesis and reflectance across large areas. Ultimately, this will allow scientists to apply their findings more broadly and predict future changes in forest carbon storage — and that has some potentially big implications for climate change projections.

“It’s a bit of a paradox that we can learn more about plant growth from the wavelengths they’re not using in photosynthesis than the wavelengths they are using,” says Scott Ollinger, director for the UNH Earth Systems Research Center who is leading the UNH portion of this project. “It’s kind of like learning what your neighbors are up to by going through their garbage instead of going into their house and watching what they’re doing.”

This summer, Ollinger will begin collecting comprehensive tree data with help from UNH graduate student Jack Hastings and research scientist Andy Ouimette. Their focus will be on Northeastern broadleaf forests; Massachusetts’ Harvard Forest, New Hampshire’s Bartlett Experimental Forest and the Thompson Farm forest will serve as the initial data collection sites.

This UNH research team will collaborate with scientists from the National Ecological Observatory Network (NEON), who will conduct flyovers of the forests to collect the infrared reflectance data, and researchers at the Rochester Institute of Technology in New York, who will use computer models to simulate changes in infrared reflectance based on various characteristics of simulated three-dimensional forests. The simulations will indicate what tree characteristics influence infrared reflectance the most.

In addition to making the measurements from satellites easier and more accurate, Ollinger believes this research could illuminate other ecological connections as well. For example, the amount of infrared light that’s absorbed or reflected by high versus low nitrogen forests varies widely enough to influence the amount of heat generated over large areas of the Earth’s surface. This has an influence on climate, but scientists need to understand the mechanism before including it in climate change models.

“The link between nitrogen and surface heating by the sun is one of the most interesting puzzles I’ve encountered working in this field,” Ollinger says. “It suggests an emergent property of ecosystems that we can presently only speculate about.”

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Sound Waves of the Future

UNH receives grant to train the ocean acoustics workforce

Tuesday, April 27, 2021

A NEW GRANT WILL ENABLE STUDENTS AND PROFESSIONALS TO ACCESS MORE UNDERWATER ACOUSTICS TRAINING COURSES IN THE FUTURE.

Students and professionals who want to expand their underwater acoustics knowledge-base will have even more options available through UNH in the coming years. The UNH Center for Acoustics Research and Education (CARE) has received a $750,000 STEM grant from the U.S.

Office of Naval Research to build a training program that will help develop and sustain an ocean acoustics workforce composed of military and civilian applications related to security, remote sensing, conservation and exploration.

Through a combination of traditional classes, certificates and professional development courses, CARE faculty will develop an improved educational infrastructure to ensure the underwater acoustics workforce is adequately trained in new research and technology advancements. The grant also will enable the development of distance education capabilities to better serve all audiences.

“Education in underwater acoustics, a national naval responsibility, is critical at all levels to meet current and future workforce needs,” says Jennifer Miksis-Olds, director for CARE and the PI on the grant. “This grant money will support additional new courses in the field of ocean acoustics, support the implementation of a new graduate certificate in acoustics and more strongly connect us with our Navy partners through internships supported through Educational Partnership Agreements with Portsmouth Naval Shipyard and the Naval Undersea Warfare Centers in Newport, Rhode Island, and Keyport, Washington.”

Currently, CARE’s educational offerings include two week-long underwater acoustics short courses: the BioAcoustics Summer School for graduate students, and the Marine Acoustics, Sonar Systems and Signal Processing Short Course, which is geared towards scientists and engineers.

Miksis-Olds anticipates the new educational offerings also will benefit students interested in mechanical and ocean engineering, ocean mapping, oceanography, and marine robotics — all of which impact naval workforce needs.

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Sea Change

Research indicates climate change affects deep-sea corals and sponges differently

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Thursday, April 22, 2021

PHOTO BY NOAA

Corals and sponges are important foundations in ocean ecosystems providing structure and habitats that shelter a high number of species like fish, crabs and other creatures, particularly in the seamounts and canyons of the deep sea. UNH researchers have discovered that when it comes to climate change not all deep-sea corals and sponges are affected the same and some could be threatened if average ocean temperatures continue to increase in the deep sea of the Northwest Atlantic.

“These deep-sea corals and sponges are ecologically important because they are foundational species that contribute to the food web, and losing them could eventually lower the biodiversity of the deep sea,” said Jennifer Dijkstra, a research assistant professor in UNH’s Center for Coastal and Ocean Mapping.

"These deep-sea corals and sponges are ecologically important because they are foundational species that contribute to the food web, and losing them could eventually lower the biodiversity of the deep sea."

In their study, published in the journal Global Ecology and Biogeography, the researchers combined data about temperature, dissolved oxygen, salinity and depth with high-resolution underwater video of the seafloor. The video was collected by a remotely operated vehicle (ROV) along the Northeast Canyons and New England Seamount Chain by the National Oceanic and Atmospheric Administration (NOAA) Ocean Exploration and Research branch. The researchers analyzed the data and annotated the ROV video to determine the density of the corals and sponges in specific areas, allowing the scientists to identify their location. They linked environmental variables to emerging patterns and high densities in narrow environmental ranges. Although corals and sponges co-occur, climate-related variables temperature, salinity and dissolved oxygen contributed to the distribution of sponges, whereas seafloor properties of slope and substrate contributed to the distribution of corals.

“The paper shows that not all deep-sea corals and sponges were influenced by the same environmental variables and each has different levels of sensitivity,” said Dijkstra. “Changes in temperature and dissolved oxygen that go beyond what the deep-sea corals and sponges are used to could stress the species’ physiology affecting growth, tissue loss and reproduction.”

In general, deep-sea corals are found 200 to 10,000 feet below sea level where sunlight is nonexistent. Unlike shallow-water coral reefs, which are limited to warm tropical waters, deep-sea corals are found throughout the world's oceans, from tropical to polar regions, forming groves of tree or fan shapes that can reach feet to meters tall. Deep-sea sponge populations can filter water, collect bacteria and process carbon, nitrogen and phosphorus. Deep-sea corals and sponges have been found on continental shelves, canyons and seamounts in deep seas around the world but their full extent is unknown because only 15 percent of the Earth’s seafloor has been mapped with high-resolution imaging.

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As N.H. Warms, UNH Studies Effects of More Freeze-Thaw Cycles

Alix Contosta delves into her research on winter weather whiplash

Listen to the segment on New Hampshire Public Radio

A Simple Instrument for Outer Space

Researchers designing compact, economical instrument to study solar wind

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Friday, April 16, 2021

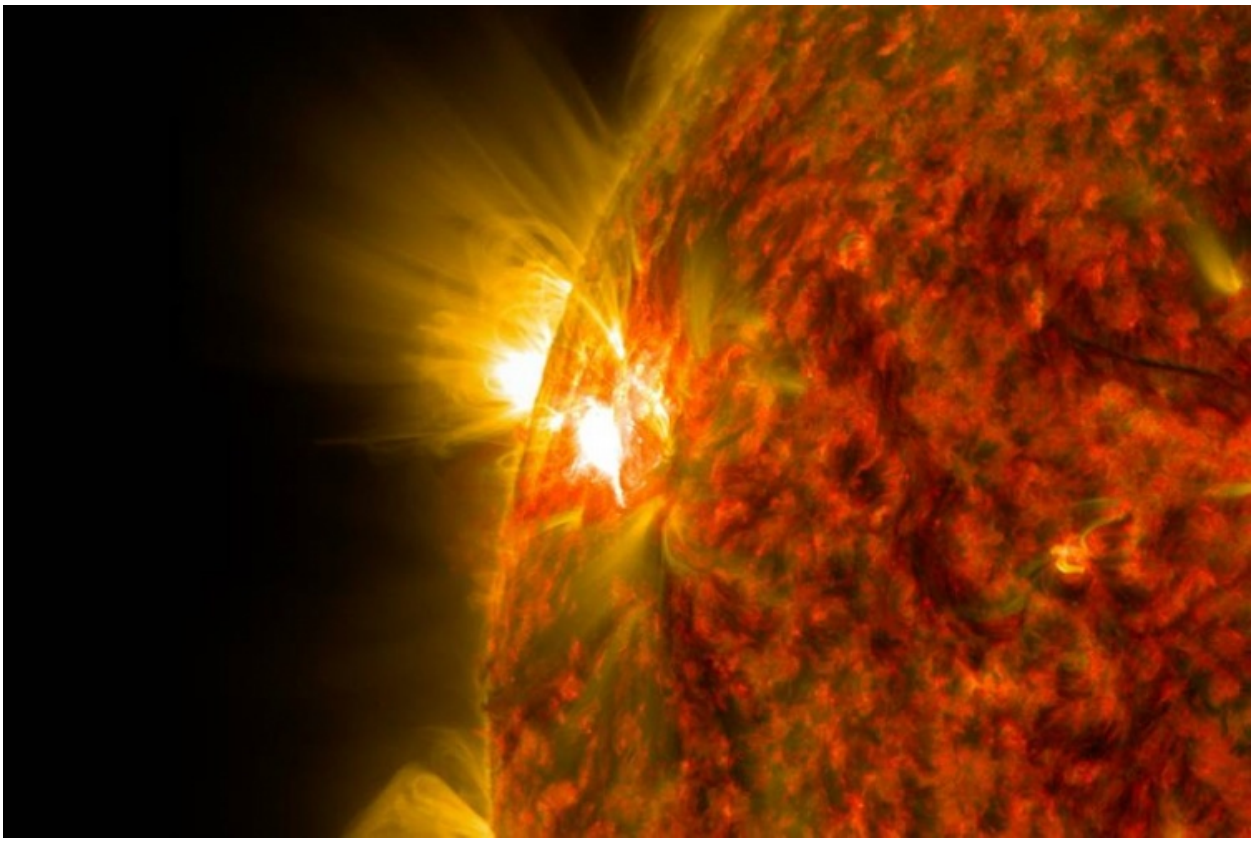

IMAGE: NASA/SDO

Sometimes the best things come in small packages, including the ones destined for space.

UNH researchers will optimize the design of a compact, relatively simple space instrument to measure protons in the solar wind. Their project was selected for a $50,000 mini award by N.H. NASA EPSCoR within their research and infrastructure development cooperative agreement.

UNH has a history of building cutting-edge space instruments that help scientists learn more about the sun and the composition of the plasma it emits, but the equipment tends to be very complex — which often means they are massive, expensive, and very heavy. Scientists like Noé Lugaz, a research associate professor in the UNH Space Science Center and the lead PI on this project, who want to study just one component on the solar wind — the protons — need a more streamlined instrument. This grant will enable Lugaz to begin preliminary design of such an instrument, called a compact electrostatic analyzer (CESA).

“As small launchers and rideshare opportunities develop and as NASA launches instruments for space science and space weather research, there is an advantage for UNH to have a complete design for a relatively light and inexpensive instrument,” explains Lugaz. “We just need something to characterize the proton population in the solar wind, and this CESA will help us to measure that. This would complement more complex instruments such as the Heavy Ion Sensor on Solar Orbiter that are able to study the composition of the solar wind”

Lugaz will collaborate with Toni Galvin, the director for N.H. Space Grant and N.H. NASA EPSCoR, David Heirtzler, a UNH research project engineer, and others from the UNH Space Science Center to develop the design over the course of 2021.

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$3.8 Million For Climate Change, Snow Depth and Space Research

Grants to focus on key research areas

Thursday, April 15, 2021

Three researchers from UNH's Institute for the Study of Earth, Oceans and Space have received grants from different government agencies totaling over $3.8 million. The

projects will focus on designing, building or implementing state-of-the-art technology to help gain insight into three key research areas.

Impact of Seasonal Freezing and Thawing

Alexandra Contosta, research assistant professor in UNH's Earth Systems Research Center, has been awarded a $1.2 million grant from the U. S. Department of Agriculture (USDA) to study the impact of seasonal freezing and thawing which is a dominant control on nutrient and carbon cycles and affects soils in forests, urban settings and agricultural ecosystems.

The team of ecologists, hydrologists, engineers and climate scientists will develop, test and deploy new state-of-the-art wireless sensing technology to help bridge the gap in assessing the timing and extent of frozen soil and its effect on ecosystems. Researchers will pair the wireless frost sensors, called FroSen, with an unpiloted aerial system (UAS) using ground penetrating radar technology to better understand how rapidly warming winters punctuated by extreme cold snaps might impact soil's freeze and thaw. They will also engage middle and high school kids as student scientists to build their own low-cost soil frost sensors and collect data on changing winter snow and soil conditions.

Drones and Snowpack Surveillance

Jennifer Jacobs, professor of civil and environmental engineering, received a $1.5 million grant from the U.S. Department of Defense to look at new ways to use an unpiloted aerial vehicle (UAV), or drone, to monitor snowpack depth to better support the military's humanitarian efforts like the management of water resources and security as well as possible tactical land surface applications in colder weather northern regions around the world.

Researchers will leverage UNH's cold-regions expertise as well as UAV experience with multi-sensors like thermal and LiDAR, which uses lasers to measure distances. The team will develop new ground and airborne technologies to characterize cold-region effects that will help guide military operations and develop novel applications for lightweight, low-cost drone sensors that provide real-time updates of snow and ice depths in cold weather environments.

Measuring Sun Particles Affecting Earth's Radiation

Chris Mouikis, a research associate professor in UNH's Space Science Center, received a grant for $1.15 million from the National Aeronautics and Space Administration (NASA) to design, build and test a hardware system that will allow for better measurement of plasma ions in the heliosphere, a bubble surrounding and protecting the solar system, which can be utilized in the design of future missions. The goal is to measure the plasma ion's wide range of activity as a spacecraft travels through different regions of the heliosphere, which can be challenging, especially when scientists try to measure more than one type of ion.

The Sun sends out a constant flow of ions and electrons, called the Solar Wind, that travels past all the planets before it is slowed down by the matter and radiation from the

rest of the galaxy. This forms a giant “bubble” around the Sun and its planets, called the heliosphere, that limits the amount of harmful cosmic radiation reaching Earth. In addition, Earth has its own magnetic shield, the magnetosphere, that limits the radiation exposure during solar storms. Radiation exposure can pose risk for humans in space, damage space instruments, adversely affect satellites and even influence the Earth’s atmosphere.

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